



US Army Corps
of Engineers
Detroit District

Great Lakes Update

High Water Level Concerns

This quarterly issue of the Great Lakes Update provides a summary of Great Lakes current water level conditions. Also included is information on erosion issues and key permitting requirements for construction of coastal protective structures.

Recent Weather Conditions

During much of the 1996-97 winter, the jet stream provided milder, moist Pacific air to the Great Lakes region. When outbreaks of arctic air occurred during mid-December and January, bitter cold winds crossing the warmer Great Lakes resulted in large accumulation of lake effect snows.

This winter again saw extremely heavy snowfall over the Lake Superior basin and across the northern parts of the Lakes Michigan and Huron watersheds. A total of 258 inches of snow fell this winter in Marquette, Michigan by April 1, 1997, as compared to the April 1, 1996 cumulative snowfall of about 207 inches. The average snowfall accumulation by April 1 is 154 inches.

The National Weather Service outlook for April 1997 is for near average temperatures and precipitation across the eastern half of the United States, including the Great Lakes. Normal patterns are expected to extend into June. The prospect of milder late-winter temperatures suggests that the snowmelt could be more gradual than what occurred in 1996.

Great Lakes Water Levels

Lake Superior

Lake Superior started 1997 at 602.33 feet, 8.7 inches above its January 1, 1996 level. This was 9.4 inches above the January long-term average (LTA) of 601.54 feet. The lake

reached its spring low of 602.03 feet on March 1, 1997. At the beginning of April, the level was at 602.03 feet, 8.7 inches above the April LTA. The current six month projection indicates Lake Superior's September level is expected to be about 602.79 feet, or 6.3 inches above the September LTA and 5.1 inches below the September 1985 period of record high of 603.22 feet.

Lakes Michigan-Huron

The Lakes Michigan-Huron January 1, 1997 water level was at 580.02 feet, 16.9 inches above its level on January 1, 1996. This was 17.3 inches above its January LTA. The gradual seasonal decline ended in December 1996 at 579.89 feet. Since then, Lakes Michigan-Huron has been rising and at the beginning of April was at 580.38 feet, 18.1 inches above the April LTA. Levels are expected to continue rising during the summer, peaking in August at an expected level near 581.43 feet, or 24 inches above the LTA for August, and 6.7 inches below the August 1986 record high of 581.99 feet. The September level is projected to be about 581.30 feet, or 24.4 inches above the September LTA.

Lake St. Clair

Lake St. Clair started January 1997 with a level of 575.52 feet, which was 23.6 inches above its 1996 starting level of 573.56 feet. This was 23.2 inches above the January LTA, and 15.0 inches below the January 1986 high of 576.77 feet. Levels are expected to peak in July at about 576.71 feet, or about 5.9 inches below the July 1986 high of 577.20 feet. Ice retardation and above average precipitation caused Lake St. Clair's to start rising in December. There was a slight drop from January to February, but in February, Lake St. Clair continued its rise. Lake St. Clair's level at the beginning of April was 576.31 feet, or 6.3 inches below the April 1986 high of 576.84 feet and 24.4 inches above the April LTA.

The six month forecast indicates that the lake will peak in July at a level near 576.71 feet, which would be 23.3 inches above the July LTA and 5.8 inches below the July 1986 extreme high of 577.20 feet.

Lake Erie

Lake Erie water levels started January 1997 at 572.63 feet. This was 18.9 inches above the starting level in 1996 of 571.06 feet. At the beginning of April the level was 573.62 feet, which is 24.8 inches above the April LTA, and 5.5 inches below the 1985 record high of 574.08 feet. Lake Erie levels have been rising since November 1996 when the seasonal decline ended and are expected to peak in June at about 573.88 feet, or 23.6 inches above the June LTA and 4.7 inches below the June 1986 record high of 574.28 feet. The six month forecast indicates that the September water level is expected to be about 573.29 feet, which would be 22.8 inches above the September LTA and 3.5 inches below the 1986 September high of 573.59 feet.

Lake Ontario

Lake Ontario started rising from a November 1996 mean of 245.14 feet, reaching 245.31 feet at the start of January 1997. This was 8.7 inches above the January LTA and 15.4 inches below the high of 246.59 feet set in January 1946. At the beginning of April, Lake Ontario was at 246.36 feet and continuing to rise. The six month forecast indicates that the lake will peak in May at about 247.05 feet, 11.8 inches above the May LTA. The September level is expected to be about 245.83 feet, 7.5 inches above the September LTA.

Erosion Processes

With the return of higher water levels, shoreline property owners have been expressing concern about erosion and how it may be related to high water levels.

Erosion is defined as the wearing away of land by the action of natural forces. On the coast, the forces of erosion are embodied in waves, currents and wind. Surface and groundwater flow, and freeze-thaw cycles also play a role. Not all of these forces may be present at a particular location. Though erosion is a natural process, it can be influenced, both adversely and beneficially, by human activity.

There are a variety of general shore types in the Great Lakes region, including high and low rocky bluffs; low flood plains and coastal marshes, high and low sand/till bluffs, sand dunes, and artificial coastlines. Of the erodible shore types,

the two most common are sand/till bluffs and sand dunes. These shore types are comprised of material deposited by glaciers over ten thousand years ago.

The sand/till bluff shore type is most often characterized by an underlayer of a less erodible, more compact material, such as clay or glacial till, overlain by a more erodible, less compact material, such as sand and gravel. Because of the presence of the compact underlayer, these shore types have been referred to as "cohesive coasts". Due to the variation in depositional environments, the composition and erodibility of cohesive coasts may vary considerably over distances as short as several hundred yards.

The sand dune shore type is generally comprised of glacially deposited sands and gravels that have been reformed by winds. Although there are dune shore types that consist entirely of sand, very often the "dunes" sit atop an underlayer of glacial till. The erodibility of this shore type can be more similar to a cohesive coast than to a dune shore type comprised entirely of sand.

Figure 1 presents a cross sectional view of a typical beach profile showing significant features and related terms. The erosion process occurs within an area roughly from the bluff crest out into the nearshore to a water depth of about 30 feet.

Forces associated with waves which are created by the wind are the primary agent of erosion on the coastal area. The energy in a wave is related to meteorologic factors such as wind speed and duration and is also determined by topographic and hydrographic factors such as the distance, or fetch, over which the winds blow, and by the depth of water in the area where the waves are generated. Water depths throughout the Great Lakes are much greater than necessary to support the largest waves that can be generated.

The most dramatic erosion often occurs as a result of storms, partially because the highest energy waves are generated under storm conditions. Added to this, storms often produce short term shifts in lake levels as water is pushed from one side of a lake to the other, called "setup". The effect of storms is also influenced by their duration and frequency of occurrences.

Bluff recession, or the landward movement of the bluff crest, is the most visible aspect of coastal erosion and receives the most attention. However, using only bluff recession as an indicator of erosion rates, or erosion forces, may be a poor indicator because of the length of time, or lag, that usually occurs between beach erosion and bluff recession.

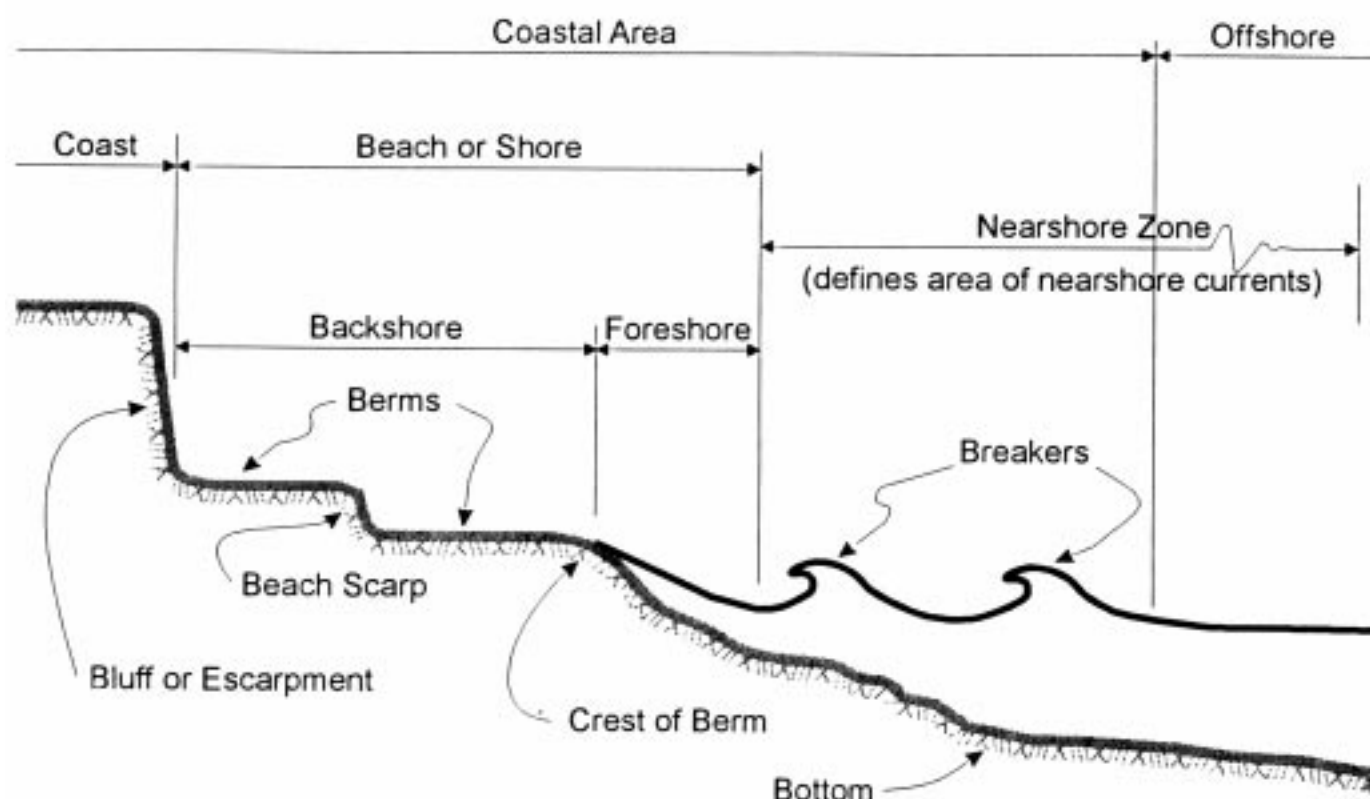


Figure 1: Cross-sectional view of a typical beach profile showing significant features and related terms.

Coastal erosion occurs over the area roughly from the top of the bluff out into the nearshore region to about the 30 foot water depth. As a result, erosion processes (particularly those that occur or originate offshore) often do not become apparent as bluff erosion or bluff recession until days, weeks, months or even years have passed.

In addition, erosion, particularly bluff erosion and recession, do not occur at a constant rate. Over relatively short time periods of day, weeks, and months, the rate of erosion and recession may vary greatly. It is very common for a reach of coastline to have no bluff recession for months or years and then experience severe bluff recession over a period of days or weeks.

Bluff recession is often the result of events that may have occurred months before, or gradually over a period of years. This makes it difficult to link bluff recession with the forces or influences that are responsible.

On the Great Lakes, lake levels have no significant effect on any of the forces that cause coastal erosion. Variation in lake levels, whether short or long term, have little effect on the creation of waves, the primary erosion agent. Most waves are generated far offshore in deep water where such relatively small water level variations are insignificant.

As long as the long-term meteorologic and hydrographic factors that determine wave energy remain the same, the long-term erosion rate would remain essentially unchanged. The lake level does, however, have an effect on where wave energy is dissipated on the beach profile, and thus may affect bluff recession rates over short time periods.

The lake level is only one of many factors influencing coastal erosion and recession. To date, the relative importance of lake level compared to the other influencing factors has not been fully quantified. Observations suggest that along much of the coast, storm duration and return frequency, and sediment supply have much more influence on coastal erosion and recession than higher lake levels do.

Regulatory Permit Program

In shoreline areas subject to erosion, property owners often want to undertake remedial or preventive measures to prevent damages. Generally before remedial or protective measures can be constructed, a Department of Army permit is required.

Water levels of the Great Lakes are influenced by a number of factors, of which rain and snowfall are significant. Water, in the form of rain or snow, that falls on land is often retained on the land. Wetlands provide an important role in the controlled release of these trapped waters to the Great Lakes. Snow by virtue of its natural state is not released to surface water bodies until it melts. Again, wetlands provide a controlled release of this water to the Great Lakes. Once released the receiving waters are altered, usually taking the form of elevated water levels. Potential results of these increases in water levels are flooding and erosion of the shoreline.

This delicate balance between land and water is natural. It is not until people come along and alter this process that a shift in the balance becomes a problem. The altering or loss of wetlands results in a reduction of the land's ability to control runoff of water to the Great Lakes. Development along shorelines in itself may not be a problem. However, an area that previously experienced natural erosion may become a problem because there now exists human development.

Because people are adaptable, we are capable of altering or modifying natural processes in order to suit our own needs. We are capable of constructing or modifying the shoreline so that our needs are met in lieu of the natural needs of nature. Work that results in the discharge and/or placement of fill material or work that takes place in waters of the U.S., including wetlands require, authorization by the Department of the Army (DA) prior to the commencement of work.

In addition, State and/or local governments may have separate permitting requirements that must be complied with prior to undertaking any shoreline work. Contact your local Michigan Department of Natural Resources or Department of Environmental Quality offices for further information.

Section 404 of the Clean Water Act requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including wetlands, prior to conducting the work (33 U.S.C. 1344). For regulatory purposes, the Corps of Engineers defined wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions.

In addition, Section 10 of the Rivers and Harbors Act of 1899 requires that a DA permit be obtained for all structures or work in or affecting navigable waters of the U.S. prior to conducting the work (33 U.S.C. 403). Navigable waters of the U.S. are defined in part, in freshwater systems as those waters landward to the ordinary high water mark, which are presently used, or have been used in the past or may be susceptible to use to transport interstate or foreign commerce.

Typical activities which require DA authorization include the discharge of dredged or fill material, including land clearing activities, in waters of the U.S. for the construction of breakwaters, bulkheads, and the placement of rubble-mound riprap shore protection. These are typical projects constructed to provide protection against flooding and/or erosion. These activities require the proponent of the project to apply to the Corps for the appropriate authorization prior to commencement of the work.

As the result of anticipated high lake levels and potential seasonal storms, the demand for shoreline protection permits is anticipated to increase. The permit application process does take time, and with the appropriate attention given to up front planning of the requested development, the time necessary to process an application generally does not pose a problem. However, some circumstances dictate that a more expeditious process is required.

The Corps of Engineers has in the past provided an expedited review of shore protection proposals in the past, as need arose. Such reviews are based on the immediate threat that current or pending conditions may have on life, property, or economic well-being. The Corps is dedicated in continuing to provide such service. Again, early planning lends itself to better designed projects that will work for seasons to come, and also allows the regulatory agencies sufficient time to provide the proper review for such projects. This review ultimately reduces, if not eliminates, unnecessary delays and concern for the applicant. So it is imperative that planning for such activities start now, before the emergency occurs.

The Corps of Engineers is committed to assisting the public with regard to this need. Not only can the Corps provide the public with information regarding the regulatory program and application procedures, it can also provide some time-proven design concepts for shoreline protection. A map of Detroit District regulatory jurisdictional boundaries is included herein as an insert for future reference; this insert also provides points of contact for further information.

Corps Jurisdictional Boundaries



① Marquette Field Office

U.S. Army Corps of Engineers
1030 Wright Street
Marquette, MI 49855
Phone: (906) 228-2833
Fax: (906) 228-3738

(B.) Soo Field Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
St. Marys Falls Canal
Sault Ste. Marie, MI 49783
Phone: (906) 635-3461
Fax: (906) 635-3474

(C) Grand Haven Field Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
P.O. Box 629
Grand Haven, MI 49417
Phone: (616) 842-5510
Fax: (616) 842-6141

(D.) Detroit District Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
P.O. Box 1027
Detroit, MI 48231-1027
Phone: (313) 226-2218
Fax: (313) 226-6763

(E.) Saginaw Field Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
P.O. Box 428
Essexville, MI 48732
Phone: (517) 894-5451
Fax: (517) 892-4523

(F.) South Bend Field Office

U.S. Army Corps of Engineer
6910 N. Main Street
Box 52
Granger, IN 46530
Phone: (219) 277-6044
Fax: (219) 277-6108

NOTE: See reverse side for information on Chicago District and Buffalo District.

For Areas outside of the Detroit District jurisdiction contact either of the offices below:

Chicago District Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
111 N. Canal St., Suite 600
Chicago, IL 60606-7206
Phone: (312) 353-6433
Fax: (312) 353-2141

Buffalo District Office

U.S. Army Corps of Engineers
ATTN: Regulatory Branch
1776 Niagara Street
Buffalo, NY 14207-3199
Phone: (716) 879-4313
Fax: (716) 879-4310